Texas A&M University
Department of Civil Engineering
Construction Engineering Report
Summer 2001

A Comparison of Current Naval Facilities Engineering Command Field Office Staffing Methods, State Staffing Methods and the Construction Industry Institutes Owner Contractor Work Structure

By Lieutenant Michael Monreal, Civil Engineer Corps, U.S. Navy

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Acknowledgments:

Many thanks are due to the officers who assisted me in retrieving data from LANTDIV HQ, especially Captain R.J. Clark, Civil Engineer Corps, Operations Officer for the Atlantic Division of Naval Facilities Engineering Command. Also Lieutenant Scot Sanders, Civil Engineer Corps, who is a project manager currently working on several projects in Europe. Lieutenant Commander Leanne K. Aaby, Civil Engineer Corps, U.S. Navy assisted in further defining issues and analysis at the intermediate level of engineering field activities in Europe. Mr. John McLaren of LANTDIV also provided further clarification concerning the staffing model. Lastly and most importantly I thank my wife and children for their support and encouragement throughout my entire Master of Engineering program.

Abstract: This report was generated by accepting a report topic contained in a list of topics on the Civil Engineer Corps Graduate School Information web page. The topic request and description is noted as follows:

Topic. *How to Measure Staffing Requirements in ROICC offices and Other Acquisition Functions with a description*

Description. *We base current staffing requirements on history and only adjust from what we have used in the past years. It is suspected that there is a difference between East Coast and West Coast but do not have numbers to back it up. A long time ago there was a chart used for Resident Officer in Charge of Construction (ROICC) positions showing both $ in Work in Place (WIP) and number of projects handled showing the number of engineers, con reps, clerks, etc. but is has not been used for about 15 to 20 years. Maybe there should be a current chart or some other consistent means of measuring staffing needs that accounts for type of work, size of projects, as well as Design in Place (DIP) and WIP. Research what private industry uses. Look for some method that can be used by all.*

In addition to the report listing, the report topic attracted my personal interest based on experiences in a construction field office that at the line level seemed to be understaffed for the amount of work in place (WIP) produced by the field office. In addition, several engineers currently in the field have identified the same issue and thus this topic is worthy of study. Several issues were identified by various Civil Engineer Corps Officers that include:

- NAVFAC uses work in place (WIP) to determine staffing for construction contract field offices.
- Projects with equal WIP projections do not reflect the degree of complication or difficulty in the staffing algorithm.
- WIP is based on past work not on future requirements

These are only a few of the issues as construction projects of various sizes involve a tremendous number of people. Organizing their efforts would be complex, even if they all worked for the same company. The federal government alone owns more than 500,000 buildings and facilities worldwide valued at more than $300 billion and spend more than $20 billion per year on design, construction and renovation of facilities. (NRC) The staffing required to accomplish this is tremendous and the coordination involved is extensive. The division of effort and methods of coordination and skills required change as projects move through the various phases of engineering, procurement and construction. Identifying the skills and numbers of personnel for an organization becomes a critical function for success.

While designing, procuring or constructing, organizations use a combination of planning and immediate problem-solving techniques. The use of teams in the construction field office is central to the construction project approach because the project team is where the decision-making process is held. The project management team is composed of responsible personnel that are experts in their field and represent the various contracted parties. Their mission is to accomplish the work, including coordinating the engineering, procurement, construction and startup phases. The project team created to tackle a problem should be composed of individuals whose history and skills are matched with the tasks at hand. This team should be constructed so that the skills of its individuals are combined to serve the overall purpose of the team. This team oversees the project, reviews and approves vast amounts of information, establishes policy, solves problems, makes decisions, coordinates, and communicates. Therefore the project team's function is vital to project performance. That is the purpose of this engineering report. The number, quality and skills of the personnel assigned to the various construction offices can impact the success of the office and the agency as a whole. Therefore, it is imperative that the staffing of Navy construction contract field offices is analyzed for possible future improvements.

In the past 20 years there has been a movement by engineering organizations to outsource non-core functions. The outsourcing of functions is a result of agencies reorganizing to

improve process performance or "reengineering". The goal of reengineering in the public agency concerning facility acquisition is to increase customer service, timely project completion and cost effectiveness or acquire a facility better, faster and cheaper. The purpose of reengineering, then, is to streamline the organization by focusing on core competencies required to successfully accomplish the mission.

As modern companies grow or are affected by budgets or market shifts, they tend to reorganize to better fit their strategic business requirements. Reorganizing, "right-sizing" or "re-engineering" is a continuous process that attempts to balance conflicting values and current facilities requirements. This reorganization produces the skills and number of personnel required that make up the management team at the field and project levels. Many civil engineer corps officers have posed the question, "Why is the construction contract field office seemingly undermanned?" I offer the argument that if the correct combination of skills and numbers of personnel are not identified and selected, the agency will not operate at optimum performance or successfully complete the mission.

Table of Contents

INTRODUCTION

Engineering Report Scope. The scope of this report is to identify and analyze current staffing methods of the Naval Facilities Engineering Command (NAVFAC) and compare state departments of transportation methods and the Construction Industry Institute's (CII) Owner Contractor Work Structure (O/CWS). By comparing private industry and state staffing and organizational methods, recommendations can be made to meet the future demands in naval facilities engineering, procurement and construction.

Methodology. The topic of this report was selected from a list of issues generated by the senior level engineering management across the Naval Facilities Engineering Command (NAVFAC). The list is posted on the Civil Engineer Corps website and is available to all graduate students nationwide. After the topic was approved, a search for previous literature or research was conducted on this specific topic. There were no other reports, theses or dissertations located at the Naval Post Graduate School, Naval Academy, Texas A&M University or University of Texas libraries. Therefore, due to the lack of reports or research in this specific area, a decision was made to start the process of analysis by comparing the current NAVFAC staffing model, with the civilian construction industry staffing methods and identify improvements. Finally, recommendations can be made to continue current staffing methods or conduct further research into appropriate public sector staffing methods in which NAVFAC could consider.

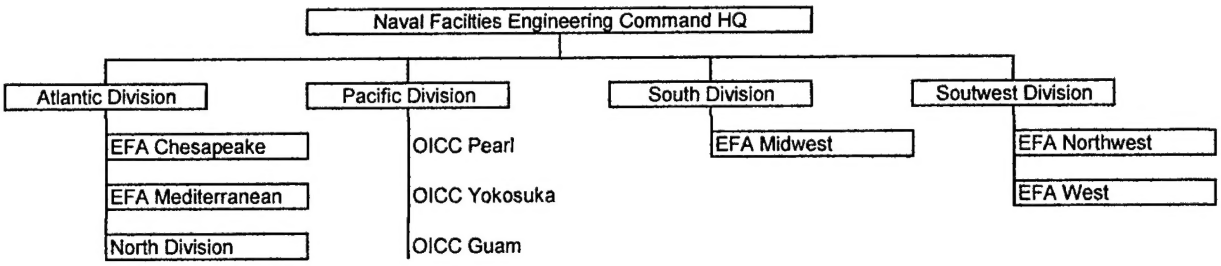
The research was conducted in two phases: a literature search and questionnaires emailed to the various Engineering Field Activities (EFAs) in the Naval Facilities Engineering Command (NAVFAC) structure. A letter via email was sent out to each major division and activity, but only the Atlantic Engineering Field Division (LANTDIV) and EFA Mediterranean responded. LANTDIV responded for the entire east coast and the Mediterranean. This report is based on the data and methods LANTDIV uses for its field offices. It is of importance to note that none of the Engineering Field Divisions (EFD) uses the same method of staffing. Thus, the NAVFAC staffing model is valid for the east coast offices only.

The research included several reviews of case studies conducted by the Construction Industry Institute (CII) to identify the major issues involved with major dilemmas facing owners as they reorganize their company. The case studies ranged from state highway department staffing reviews to case studies focusing on medium to large capital projects in the industrial sector. This approach has the drawback of not providing statistically rigorous results; however, it provides a deeper understanding of major issues and is poised to be a basis and rational hypothesis for future statistical studies and research.

There are few publications in circulation dealing with project construction staffing and even less for resident or field offices. Recently, however, the Construction Industry Institute has conducted extensive case studies to formulate basic work relationship principles. Many principles that were researched are concepts taken from the private industry from an owner's perspective; this is the basis for the comparison of the government and private industry staffing methods.

In addition, a publication with major implications for the report topic was received during the writing of this report. Published by the National Research Council, it discuses outsourcing the management function for the acquisition of federal facilities. The publication confirms this report on a global level and touches on the need for public agencies to implement staffing methods based on core competencies; however, this report focuses on the specific topic of staffing for the Naval Facilities Engineering Command.

Background. This report considers the U.S. Navy as the owner/end user of facilities with the Naval Facilities Engineering Command (NAVFAC) component as the engineering and construction contracting entity. NAVFAC also provides facilities for other agencies and organizations as part of their mission. Within this entity lies the Resident Officer in Charge of Construction (ROICC) that operates as an owner construction representative and operates in various field offices around the globe.



Naval Facilities Engineering Command (NAVFAC) Organization Chart

The NAVFAC hierarchy includes a chain of command from headquarters to its Engineering Field Divisions (EFDs) that maintain overall responsibility for facilities acquisition, policy planning and execution for its geographical area. EFDs are further broken down into Engineering Field Activities (EFAs) which are divided into Resident Officer in Charge of Construction (ROICC) field offices at various ports and bases throughout the world and serve as the owner's representatives to construction contractors.

The role of Navy construction contracting and management is to support the mission of the Navy by providing the fleet the highest quality homeport and deployed facilities possible. This is accomplished by turning operational and support needs (civil, industrial, medical and marine facilities) into reality by designing, coordinating, contracting and constructing those facilities. However, as the Navy is a government entity, there are certain policies implemented by the federal acquisition regulations (FAR, 48 CFR Chapter 1) that restrict business transactions that the civilian construction industry does not encounter. The Navy requires full and open competition to the public, fair proportion of contracts with small businesses, promotion of socio-economic objectives (environmental, small disadvantaged business, safety, etc.). Other constraints in business dealings are outsourcing, base operating support contracts and public-private ventures

(PPV). With these objectives in mind, the proper staffing of skills and numbers of personnel are vital to the success of the construction field office. These skills include the typical skills required by a private engineering or construction firm but also include personnel who are versed in government regulations. There are also regulated checks and balances that require separate personnel to accomplish the same business function that a single person could accomplish in the private sector.

These and other requirements make public construction management and the staffing of the construction field offices more complicated. Compounding this difficulty is the fact that internally, NAVFAC engineering field divisions do not staff using the same methods. For example, Southwest Division does not staff, nor use the same algorithms or bases for staffing like the Atlantic Division. But as will be discussed, construction field office staffing is one of the key elements in the success of an engineering and construction organization.

DISCUSSION

Organizational Considerations. In general, construction projects have a culture that requires extraordinary key player talent. The nature of construction contracting demands people who can move with the unique and dynamic conditions of a changing environment. Aside from the changing methods of construction and contracting, the fact remains that every project is different and requires the same detailed analysis. Knowing the requirements of a project environment and selecting key individuals to fit those requirements are essential to successful performance. The process for selection of key project people should be as rational and efficient as possible. As a whole, owners pay only passing attention to what skills are required of its team members. In addition, if the budget is reduced, the staff is viewed as a liability, not an asset. This can be a costly error.

Construction project management, from an owner's perspective, has several functions that team members must be able to accomplish including:

- Site supervision
- Design engineering
- Field engineering
- Scheduling
- Accounting
- Administrative support

Though not the same functions as the construction contractor's organizations, the owner's project management team maintains many similar functions including:

- Assisting in development of field staff
- Coordinating on site with main office, usually in a different geographic area
- Organizing and overseeing jobsite administration
- Organizing and coordinating field supervision
- Assisting in the procurement of materials, equipment and contractors
- Monitoring and communicating progress, schedule and revisions
- Monitoring labor force and payment

- Monitoring quality of work
- Coordinating cost progress targets with production
- Safety
- Identifying and resolving all changes
- Establishing and maintaining relationships with contractors, end users, designers and public works

There are some special assumptions that members of the construction management staff must take into account when dealing with construction contracts; every contract is different and the contract documents with respect to the owner, contractor and designer are carefully interpreted. (Civitello)

A primary driving force for a capital project is the owner's engineering and construction organization. Whether the owner executes the entire project or provides only the project scope and objectives to a contractor, it is the owner's responsibility to ensure that the capital project scope is well defined, the proper human resources are assigned to the project, the human resources retained are given the proper objectives, and the obstacles to the project's success are removed. Some other general responsibilities of owners are:

- Use sound discretion in evaluating qualifications of contractors
- Preserving the integrity of building and contract award system
- Funding work, including all changes
- Providing surveys describing physical characteristics on site (unless it is part of the construction contract)
- Securing all necessary easements and authorizations
- Warranting adequacy of plans and specifications
- Warranting suitability of furnished materials
- Disclosing of superior knowledge
- Implementing prompt action on clarifications and changes
- Acting within time periods that are within reasonable completion of progress of schedule

- Providing "final" interpretation of contract documents
- Cooperating with contractual parties
- Ultimately assuming responsibility for project

In light of these responsibilities, many owners (public and private) are reviewing and reorganizing their engineering and construction organizations and some have made changes in the way they staff construction projects. These approaches vary considerably from minimal owner involvement to integrated owner-contractor offices, while some still have full-service owner engineering organizations. Decisions to reengineer or right size owners organizations are based on (1) essential areas of expertise that are central to its profitability and (2) the managerial time and resources are limited and should focus on the organizations focus of expertise. (NRC) Public sector organizations, though, have no bottom line comparable to profitability of a business. The missions of governmental agencies are to provide services related to the public health, safety, welfare, and strategic objectives (military) and to provide it cost effectively, rather than for a profit. Thus the public sector entails different risks, different operating environments, and different management systems that all effect the staffing of the organization.

One impact of rightsizing or reengineering the NAVFAC organization staffs may be the loss of human resources that contribute to the strategic value of construction in heavy areas of military concentration or on individual projects. The value added by the owner's engineering organization may be a skill, knowledge of operations or a management issue. The solution proposed by the Construction Industry Institute (CII) to the organizational dilemma for owners stresses the importance of identifying and maintaining strategic human resources and finding ways to add value even during periodic downturns, such as decreases in the congressional military construction budget. Strategic human resource planning contributes to competitive position through cost reduction, schedule optimization, quality improvement, or risk management. (Rowings and Behling) The term "strategic" will have different meanings for different owners, but generally indicates a human resource with some special value to the owner that makes safeguarding it more advantageous to maintaining or developing a strong competitive position. In the case of

NAVFAC, an argument can be made that "strategic" implies its engineering and contract support service to the U.S. Navy, Marine Corps and the U.S. Air Force.

Through case studies, Rowings and Behling identified specific owner staffing concerns that include:

- Some employees of certain owner's may see capital project work as the lower rungs of the career advancement ladder.
- Owner engineering organization (OEO) or NAVFAC staff reductions may require the creation of new interfaces for contractor or end user interaction.
- Short-term contract hires may not have the same "values" as long-term owner personnel.
- Owner employees may have difficulty adding value to the project if their support infrastructure has been right sized.
- Owners may face huge carrying and staff reduction charges if efforts are not made to project future workloads.
- Owners may pay significantly more on a project basis if their capital project staff is reduced to project management personnel only.

Thus, a rational decision process is needed to guide owners in organizing for capital projects. This rationale should be integrated into a continuous improvement process that fulfills NAVFAC's strategic business and military support goals. The improvement process identifies the skills and quantities of personnel that will be required to match the characteristics, size, and numbers of projects to be executed in the construction program, along with the issues facing the NAVFAC engineering and construction management organization.

An interesting finding of Rowings and Behling was that owners tend to classify human resources in a number of ways; however, these classifications are not always conscious decisions. A company that has been around for 50 years might have the same capital organization today that it had 50 years ago. In the case of NAVFAC, there have been

changes in the past 10 years, but as this report topic description stated, the staffing methods have been the same for several years. The organization may put very little effort toward classifying its human resources because it has always had them. For some owners, the distinction may be as simplistic as "our people" and "their (contractor's) people". This may be adequate for small owners who complete a capital project every five to ten years, but for the multi-billion dollar international corporation or the billion-dollar U.S. Navy, project human resources should be classified fiscally, functionally and strategically. The primary difference being, the U.S. Navy design and construction budget is about $2.5 billion every year, whereas other large companies only construct a few million-dollar projects every year, if that. (NRC)

It was apparent from the case studies that Rowings and Behling conducted that owners tracked work hours on a functional basis only or failed to track project related work hours by phase. "Owners need to track work hours by project phase to have a better basis for more accurately estimating and controlling total engineering costs on future projects."(Rowings and Behling)

According to the CII Strategic Planning Committee's April 1990 report, reorganizing for strategic projects was identified as a management category for which a 20:1 payback for investment could be realized. It should be noted that their definition included objective setting, scope definition, and constructability planning. The research as stated above, not only addressed the project organization, but also the overall owners engineering organization.

Given the variety of organizations that could be developed to execute a project, it is given that NAVFAC would like to select the organization that will have the highest likelihood of successfully executing the project. The research revealed, across the private industry that there was/were:

- Limited strategic planning for capital project personnel.
- Lack of a common method for determining project staffing.

- No method to determine the effectiveness and cost of owner involvement.
- Limited involvement of technical personnel with business units during front-end loading.
- Frequent involvement of technical personnel at the proper time.
- Poor communication of project responsibilities.
- Lack of common definitions of success measures.
- Different markets have different owners engineering organizations requirements.

As a result of the findings, a rational approach to staffing was developed for overall organization and single project staffing. This report focuses on NAVFAC as a whole; therefore, it is appropriate to include the flowchart necessary to determine the owners engineering organization needed to execute the Navy's capital program. Identifying NAVFACs core competencies and implementing the steps to achieve the "best" organization can assist in the selection of the skills and number of staff needed for facilities acquisition. The steps to the continuous improvement process for strategic planning are:

1. Identify and define the capital program
2. Set detailed capital program objectives
3. Identify the issues affecting the owner engineering organization
4. Establish and list the function for the program
5. List the function for the program
6. Determine the required human resources (HR) for the function
7. If the required HR is strategic and the owner HR value added is adequate, the organization should develop and/or maintain the owner HR
8. If the owner HR value added is not adequate the organization should retrain and/or redeploy the owner HR
9. If the required HR is not strategic and the non-owner HR value added is adequate, the organization may outsource the function
10. If the non-owner HR value added is not adequate, the organization should develop and/or maintain the owner HR

This framework is noted as Figure 1 and should include all available relevant information on the capital program to be executed. The product of the function-by-function analysis (core competencies or non-core competencies) analysis is a strategic human resources development plan. The Navy should focus on the characteristics of the program that could affect the design of the "best" organization. For further information, CII Source Document 93, Organizing for Capital Projects: A Rational Approach is available through the Construction Industry Institute, Austin, Texas.

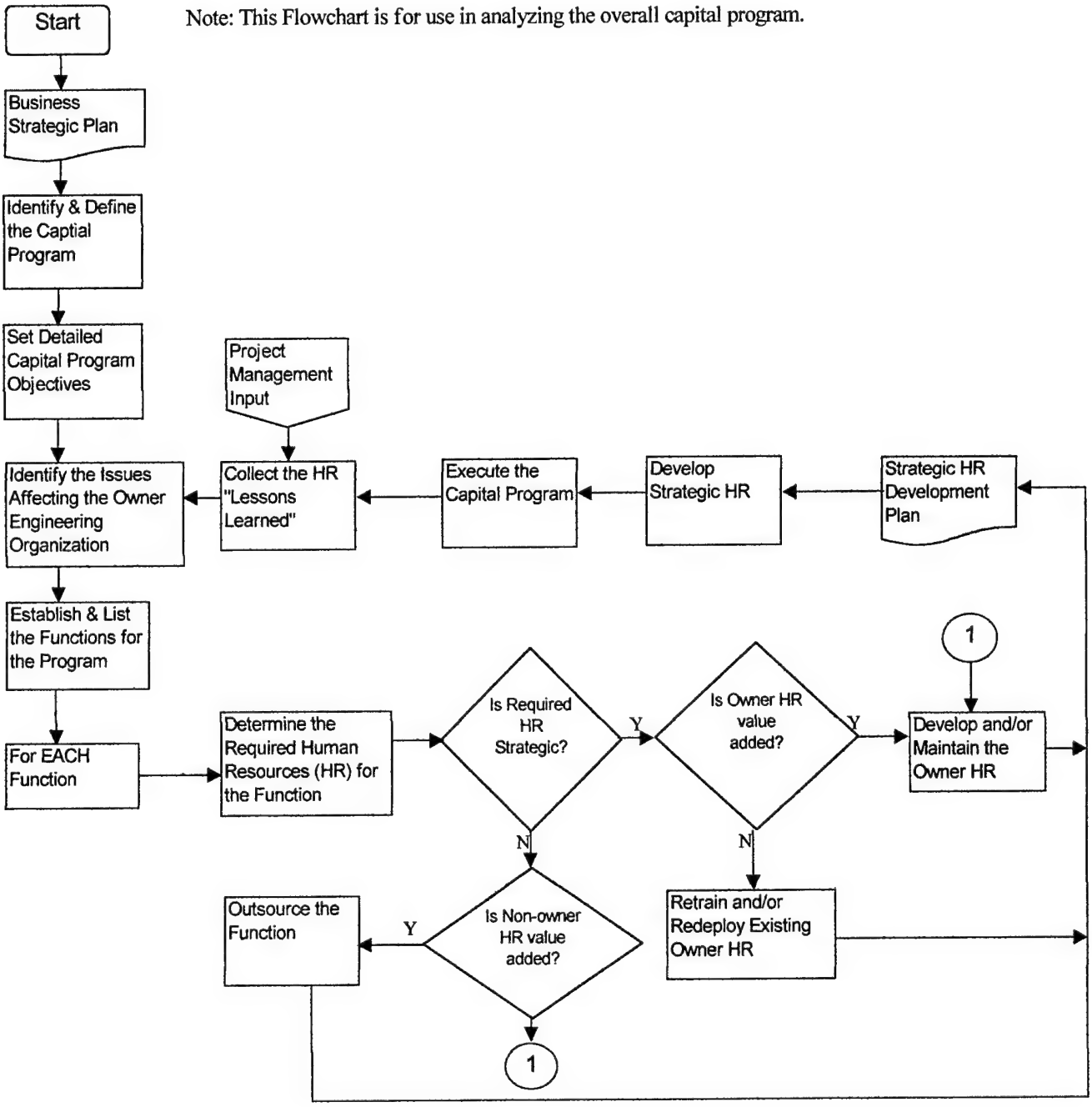


Figure 1. Continuous Improvement Process for Strategic Planning in the Owner Engineering Organization modified for this report on June 10, 2001

The consequences of the selection decisions are generated as a result of detailed research into success and performance factors conducted in all sectors of the construction industry. (CII, Pub 12-2) Making a detailed assessment of a project to determine what levels and numbers of skills are required precedes an actual selection. This may currently be accomplished at NAVFAC Headquarters and EFD levels, but the lists may be based on key individuals or "tribal" knowledge vice as an operational staffing method. These factors take on relative weights of importance that allow for factors to be traded off, or compromised. Table 1 presents factors that should be considered in project team (personnel) selection.

Project Factors as a Basis for Selection

Size of Contract	Dollar volume
Type of Contract	Lump-sum, Design-build, Percentage fee, GMP
Type of Construction	Industrial buildings, heavy/highway, specialty
Complexity	Complexity of design, construction, changes, site, environment, lifestyles
Owner-Group	Private, government, public need, owner industrial group
Support Groups	Separate A/E, In-house, Design-Build, Construction Management
Contingencies	Subcontractor availability, labor, material, disputes, risks

Table 1. Checklist Project Assessment for Personnel Selection. (CII, Pub 12-2)

Identifying people that have the technical and contractual knowledge required for the noted factors is difficult. The technical person must understand and interpret the design, engineering, and construction aspects of the project. The contract specialist must understand government policy, the federal acquisition regulations, pricing, business, and must be an excellent negotiator. Research has shown that the quality and skills of the personnel is more important than the quantity of personnel. For instance, it is better to have intermittent inspection by a skilled construction representative than full-time inspection by one who does not know what to inspect or how to inspect it. (Newman)

Public Agency Dilemmas. One of the most important areas of ROICC office management is the risk in predicting the construction program work schedule. There may be projects in the pipeline for years or fully designed projects waiting to be constructed or emergency repair projects or politically motivated projects that need to be constructed immediately. It was noted in a number of state departments of transportation that it is difficult to determine what average staff level should be maintained, thus making it essential to have multiqualified personnel who can adapt to changing circumstances on short notice otherwise known as personnel flexibility.

Another problem faced by many public agencies is the changing public attitude toward public programs, to include construction. This could be due to changes in politics or the latest economic prosperity. In some states there have been legislative pressures to do more than simply spend all the dollars in the fiscal year budget; agencies must show where and how the dollars are spent and the results that were obtained to ensure the taxpayer is aware of his/her working tax dollars. (NCHRP)

Until the corporate downsizing of the 1980s, owners of large inventories of buildings, such as NAVFAC, usually maintained in-house facilities engineering organizations at the Engineering Field Divisions who were responsible for design, construction, operations and project management. (NRC) But, the Government Performance and Results Act of 1993 (P.L. 103-62) mandated that federal agencies produce strategic plans and performance measures to "improve the confidence of the American people in the capability of the federal government by systematically holding federal agencies accountable for achieving program results" and to promote " a new focus on result, service quality, and customer satisfaction." To meet these objectives, federal agencies were given more flexibility in finding ways to perform their missions responsibly.

In the public sector, growing concern about the federal budget deficit, the continuing long-term fiscal crisis of some large cities, grassroots efforts to restrain the growth of tax revenue and limit government spending, and efforts to make government more cost effective placed extreme pressure on elected officials to cut the budget and in some cases

downsize public agency operations. These and other factors accelerated the change in the process of shifting functions and responsibilities from the government to the private sector (privatization or outsourcing). (NRC) A 1993 report by the Council of State Governments found that 78 percent of state agencies used outsourcing as their primary strategy to cut internal budgets. Thus, like private sector facilities owners, public agencies are faced with the challenge of identifying the essential technical and managerial skills that should be retained by the agency to ensure effective oversight of outsourced services. (NRC)

Pressures from environmental concerns have been an issue and have serious implications on the project-letting schedule and subsequently the workload within the agencies. Much of the planning and scheduling may be nullified when a project is halted by the judicial system. Likewise much of the planning and scheduling is invalidated when one or more projects are cleared for construction by a single court decision. (NCHRP)

Working in the public sector makes staffing all the more difficult because the factors in Table 1 may change as the industry changes in a short period of time, it is much more difficult to transfer, release or reorganize staffs in a government construction office. Therefore it is imperative that commanders and managers accurately project the staffing requirements.

For example, state highway and transportation agencies have forms of manpower guidelines that determine construction engineering staffing. Like NAVFAC, the guidelines vary considerably in form and complexity. Three basic types of manpower guidelines were identified (Newman):

- Staffing based on the dollar value of the contract
- Staffing based on the type of construction
- Staffing based on activities and contract types

Some states use a combination of the above methods for estimating manpower needs. A few agencies use guidelines for staffing federal aid projects but not for state-funded projects. But, in general, the three basic guidelines are the same as the CII factors noted in Table 1.

Dollar Value of Contract. Typical dollar value guidelines as researched by Newman, equate staffing needs to the size and complexity of the project as reflected by the dollar value of the contract. One example of this type is the Vermont Agency of Transportation. Their guidelines recommend staffing complements for up to six different project sizes for three project categories: roadway, bridge and asphalt paving. And like contract field offices on the west coast (Southwest Engineering Field Division, SWDIV), engineers and technicians for the Vermont AOT are used interchangeably in making project assignments as the government technical representative. With dollar value guidelines, no other consideration is given to the variations in project characteristics that affect staffing needs.

Type of Construction. The type of construction requires an analysis to determine what skills are required to staff the office. For instance, a naval air station may require different expertise than a port, a mountain warfare-training center, or hospital complex. For example, North Dakota maintains over twenty-three types of highway improvements in which their staffing is based. This is similar to Navy Construction Battalion (Seabee) project planning in which types of projects are categorized and have specific skills sets and numbers of personnel required for each standard project. Guidelines based on the type of construction work best where most projects fit into one of the defined types of project that are repetitively worked such as the types of work the highway departments or the Seabees do.

Activities & Contract Types. The combination of construction engineering activities and contract types provides an estimate of manpower needs based on the detailed characteristics of each project. Most state departments of transportation that use this type of guideline defines about thirty major activities and eight to twelve contract types.

(Newman) Montana's guidelines are typical. Montana's system includes eight project types and up to thirty-eight activities. The project types are:

- Construction
- Reconstruction
- Rehabilitation
- Resurfacing
- Lighting and traffic signals
- Maintenance stockpiles
- Miscellaneous
- Unique

This method is also similar to many NAVFAC field offices where the projects are assigned to functional teams that specialize in specific types of projects. For example at Marine Corps Base, Camp Pendleton, CA the field office is broken down into teams based on:

- Environmental
- Morale Welfare and Recreation
- Housing
- Barracks
- Rehabilitations
- Naval customer construction (as it is a Marine base and they use different funding systems)
- Miscellaneous
- Air Station
- Base Realignment and Closure (BRAC)

Montana also includes five modifiers that allow for increasing staffing estimates in response to special conditions in terrain, ground cover and project locations. The modifiers are applied to projects that involve:

- Traffic
- Urban areas
- Rough terrain or mountainous locations
- Substantial timber or brush
- Isolated locations where utilization of personnel between projects is not possible

No data on modifiers have been identified to date by use for NAVFAC for the various types of condition, but the applications for this provide a justifiable basis for specified increases or decreases in staff for NAVFAC construction projects.

Montana DoT's project schedules are calculated in man-hours and converted into man-months. The man-months are spread over the months in which the project is to be constructed. The staffing needs are determined on a monthly basis for all projects. These needs are then summarized to determine the personnel requirements at each state office. An allowance for leaves is added so a realistic comparison between needed and available manpower can be made. The needs are then summarized for each district across the state. Thus, the Montana DoT provides a statewide staffing system with relatively accurate requirement estimations.

The types of contracts the Navy uses will dictate to a certain extent the number of contract specialist assigned to the projects. Prior to the 1980s, the lump sum, general form of project delivery was by far the most common. Throughout the decade of the 1980s, though, construction management with Guaranteed Maximum Price (GMP), agency construction management (CM) and other hybrid forms of construction management became very common. This was motivated by the desire of owners to shorten total design and construction process. These types of contracts require various contract skills and new technologically advanced construction methods not previously

encountered. In the 2000s, to be most effective in managing projects, the Navy must begin with a thorough understanding of various forms of contracts, specified relationships among parties and complexities of projects and the skills required to properly staff construction field offices.

Frequency of Staffing Review. According to Newman, estimating staffing needs for construction engineering and inspection personnel involves at least two steps. The first is the determination of annual needs (typically conducted in the winter months for the upcoming construction season) on a monthly basis and the second is based on weekly requirements for small projects. A third estimate, which is often overlooked, is the prediction of trends in staffing needs for the outlying years (3-5 years) to improve recruiting and training efforts for NAVFAC.

Seasonal Employment to Fill the Gaps. The state departments of transportation are able to keep a minimum staffing requirement for their offices because during the construction period they were able to hire temporary technicians and inspectors, to supplement the permanent staff wherever needed. This is most advantageous to the staffing problem, but critically relies on construction season recruiting and there is an argument for possible lack of experience. Some agencies reported difficulty in matching starting average salaries offered by the construction industry that could place an agency in a bind should there be few applicants. However, college or coop students and graduating engineers filled most of the seasonal gaps because they had previously worked for the agencies. Consultants, mobile technicians and inspectors that worked for the state also filled seasonal gaps. This type of seasonal employment was advantageous because they merely commuted to the various regions of the state where the needs dictated. For instance, Maryland DoT relied nearly as much on consultants (65% in 1986) as engineers in the field. Utilizing Reserve Civil Engineer Corps Officers, mobile construction representatives and consultants during the construction season in areas of heavy NAVFAC influence such as Washington D.C., San Diego, or Jacksonville, can be beneficial in the same way.

Many states have similar problems to those of NAVFAC concerning construction office staffing. For instance, most states have some type of limitation on the number of permanent employees for construction administration. Generally, the state legislature or governor imposes this limitation. There are, however, fewer limitations on seasonal or temporary employees. For example, Maryland is limited on the number of permanent employees by the legislature, so consultants supplement the required staffing. Despite the limitations on hiring and reductions in staff, most states interviewed by Newman believed they had an adequate number of employees so long as they could supplement that staff with overtime, temporary employees and consultants. The seasonal concept obviously only applies to geographical areas that have construction seasons. Areas such as Southern California and Hawaii must modify their estimates and plan on a steady year round stream of projects.

From an analysis of both the technical and administrative aspects of a construction division's operations, it is evident that the personnel management poses two basic challenges: (a) to find some orderly and economical means for adjusting manpower to the seasonal work cycle of the construction program without sacrificing quality control and (b) to concentrate on fostering a hierarchy of incentives to improve the availability, quality, and motivation of construction staff. (NCHRP)

With these two challenges from the National Cooperative Highway Research Program (NCHRP) as a framework, some recommendations were made that included employment of a core staff and identification of temporary help (i.e. contracting services), equal pay for equal work between temporary and permanent employees, flexible work hours, and a training coordinator. These recommendations can also be extrapolated to the NAVFAC staffing concern and considered for use.

NAVFAC (LANTDIV) STAFFING MODEL

Resident Officer In Charge of Construction (ROICC) field offices in the Atlantic Division are not staffed like the rest of NAVFAC. As stated earlier, this is considered a point of interest because within the same engineering organization staffing methods vary from one geographical area to the next. This could be an underlying factor as to why there is confusion concerning the numbers of staff required. Each major region's staff determination is based off of different factors. No one method can be identified across the board in which to base staffing calculations and therefore a common staffing model for NAVFAC in general is needed for standardization.

The Atlantic Engineering Field Division has five components – Middle Atlantic, EFA Northeast, EFA Chesapeake, EFA Mediterranean and OICC Naples. Table 2 is a breakdown of the current office and personnel numbers. The numbers for staffing are based upon yearly gates, but the actual numbers fluctuate due to losses and hiring against those losses during the year.

Component	Mid Atlantic	North	Chesapeake	Mediterranean	Naples
Field Offices	12	10	8	11	1
Authorized Nos.					
Civilian	266	108	141	75	19
Military	39	18	29	27	5
Technical	182	75	102	61	14
Non-technical	123	51	68	41	10
Total	610	252	340	204	48

Table 2. LANTDIV Office and Personnel Statistics

There are a number of issues that are considered in the staffing of a ROICC field office in addition to current workload. Primary consideration includes the projection for future work based on management judgment and the five-year facilities master plan and the workload trend for that office over the last five years. Most office managers create a timeline spreadsheet with their projects. They base their estimate of future WIP on current office size, area cost factors and the traditionally early congressional approval of

the military construction budget. Therefore, it is sometimes difficult to project future WIP. For example, LANTDIV has projected a FY 02 WIP of $1.55 Billion, but is still awaiting congressional approval. The actual work hours allocated to LANTDIV might be $0.5 Billion or the full requested amount, but it is not known until close to the end of the requesting fiscal year.

A one or two year decrease in workload or gap for the office will be bridged and a corresponding spike in work will be allowed to remain. The hiring and movement of civilian personnel is a great consideration in the process of determining the size of the office, but this does not deter the reduction of staff for a long-term drop in workload. This is mainly determined by the consideration of the office managers that submit their staffing requirements and negotiate with NAVFAC for personnel work hours. The dispersion of the office is looked into as some offices may support seven geographically dispersed clients.

The WIP projection process is a series of estimates and adjustments relayed from the Engineering Field Divisions to NAVFAC. For instance, in September 2000, LANTDIV gave NAVFAC HQ it preliminary WIP projections for FY 02. Adjustments were made to the estimate and in January 2001, LANTDIV gave its final estimates to NAVFAC HQ. In September 2001 the projected WIP estimates will be readjusted with more accurate projections, but most often the final staffing numbers are held from the January 2001 estimates. Upon congressional approval of the defense budget, the work hours in budgeted dollars are made available to NAVFAC, which in turn distributes to the EFDs. The estimates provided to congress from the Navy forms the basis for the congressional negotiations and ultimately the allotted budget. The implications of this process are that the congressional budget is the primary driver for the staffing process, not necessarily projected WIP.

Like the state departments of transportation, the type and size of the projects are taken into account. For instance, a single $40 million switchgear installation contract may only require a single officer or engineer and one construction representative supported

by a contract specialist from another office compared to a fully staffed project team for the complex construction of a steam power generation plant.

The current model for staffing is based upon the model used by NAVFAC headquarters. This model is an algorithm that is adjusted for the local area cost factor and is, for overseas locations adjusted again for difficulty in getting materials, different construction methods and other international and social differences. The algorithm is based on Work in Place (WIP), submitted to the EFD Command Executive Steering Group (ESG) where the numbers are compiled and reviewed and adjusted during a Resource Allocation Process. Following the initial review, the numbers are reviewed again by the business line managers for the Command and presented to NAVFAC HQ. NAVFAC HQ looks at the organization as a whole, in light of the Navy's funding for the upcoming year, and the numbers of work hours available from the congressional budget are distributed to the ROICC components to man the field. The hours provided might only total 85 to 90 % of the algorithm. Thus, the algorithm is not the driving force to staffing, but the amount of funding allocated to construction for the bases and NAVFAC capital projects. The algorithm is as follows:

$$WH = \frac{(WIP * K_o)/[(ACF - 1)/2 + 1]}{1250}$$

WH = Work hours

WIP = Work in Place

K_o = 1.0 CONUS (Continental United States) or 1.3 OCONUS (Outside Continental US)

ACF = Area Cost Factor

Constant = 1250 is derived from historical data

The methods for staffing field offices are many and are based upon all of the factors stated above. The offices are staffed based upon the work being done and upon any specialty requirements the office may have. Each office is planned for a range of about ±$2 Million per person. This number is based on the specific situation in the office and adjusted from office to office. In addition to the work hour's algorithm mentioned

above, NAVFAC uses the NFOR (Naval forces) model that was recently developed by NAVFAC. The NFOR model was developed by the Emergency Operations Center at NAVFAC in 1998 and is based on the concept of office performance and readiness to contract the projected projects. The NFOR staffing model is:

$$\text{Staffing} = \frac{WIP1}{1.8*Afc} + \frac{WIP2}{1*Afc} + \frac{FIP}{2*Afs}$$

WIP1 = Type I Construction – construction

WIP2 = Type II Construction – repairs and renovations

FIP = Facilities Service Contracts

Afc = Adjustment Factor for Construction (ACF –1)/2 + 1

Afs = Adjustment Factor for Services (ACF – 1)/3 + 1

ACF = Area Cost Factor

The final numbers for all models are then compared with the budgeted work-hours provided by NAVFAC, distributed to each component, and the components staff their offices based upon each offices needs. Thus, it is established that though future workload is expected and accounted for by management, the congressional budget is the driving force behind the staffing algorithm.

OWNER / CONTRACTOR WORK STRUCTURE (O/CWS)

Overview. The Owner/Contractor Work Structure (O/CWS) was developed from 1994-1997 with a team of researchers and owners who wanted to ensure the success of their business as the management considered downsizing or rightsizing their organizations. Part of their strategic business resolve was to focus more on outsourcing work processes to become more efficient in their area of expertise.

The definition of the O/CWS Process is the distribution of roles and responsibilities between owner and contractor (major participants) based on key project competencies. A competency is a project work process that is comprised of functions and associated critical capabilities needed to develop and execute capital projects.

Organizational change has left many owners inadequately structured to develop and execute their capital projects. Studies have shown that many public and private agencies remain uncertain about the appropriate size and role of their in-house facilities engineering organizations. A survey by the Federal Facilities Council found that by 1999, in nine federal agencies, in-house facilities engineering staffs had been reduced by an average of 50 percent. (NRC) Personnel remaining in the organization continue to perform the same number of project functions despite reductions in resources. Senior managers are retiring, taking valuable knowledge and experience with them. Remaining personnel may not have the necessary skills, knowledge or experience to evaluate both the timing and level of their involvement in the project delivery process. This loss of expertise reflected in the 50 percent statistic is compounded by the fact that business personnel trained primarily in contracts and negotiations rather than design and construction are playing an increasingly greater role in facility acquisitions. In addition, a recent study uncovered that many public agencies have outsourced functions due to lack of expertise and staff shortages (54%) as opposed to deliberate downsizing or cost effectiveness reasons. (NRC)

The O/CWS was developed primarily to assist companies in organizing project work in light of changing conditions in the engineering and construction industry. The competitive business environment causes companies to downsize for an increase in performance and efficiency, but in the process they lose valuable resources because they have no means of identifying which skills are vital to their business. In addition to project work organization, the O/CWS also assists the owners and contractors' form optimal working relationships, addresses the problem of loss of expertise due to attrition (in the form of retirement and losing people to other companies), and assists companies in the formation of strategic business alliances. The CII has found that "most owners do not have a process to determine owner/contractor work structure, particularly one that identified project core competencies, competencies to retain in-house, and those needing to be outsourced." (NRC)

O/CWS Process Discussion. One benefit to utilizing the O/CWS process is that it provides a systematic approach to determine key organizational and project competencies and their sourcing on a corporate level. The process allows NAVFAC HQ to decide on what competencies are core or non-core and distribute those competencies to the EFDs so that the non-core functions can be outsourced. The O/CWS is a vehicle for documenting decisions related to competency evaluation and sourcing. It is hoped that by identifying the core competencies needed for success, NAVFAC will gain more efficient operations by avoiding gaps and eliminating overlaps through alignment of work structures. The process allows the various levels of the NAVFAC management to discuss the various viewpoints represented and provide a rationale for evaluating project skills and resources needed, which ultimately provides the basis for field office staffing.

The O/CWS is easy to use and is flexible and can be used in various situations, but can take considerable effort. This effort is in large part due to the required input from the various levels of management in NAVFAC and the dedication to identifying what work processes are truly vital for the success of NAVFAC.

The O/CWS process makes a distinction in its application at the corporate level and at the capital project level. Though the key concepts are the same for both levels, the corporate level precedes the capital project application. The results are that the process serves as a strategic guideline for the staffing of specific capital projects at the EFD level. The steps involved in the O/CWS process are:

1. Identify and define capital projects competencies
2. Review for completeness
3. Determine drivers behind core competency decision
4. Classify competencies into core or non-core
5. Assign appropriate owner-contractor work relationship
6. Define the role of the supporting participant
7. Estimate owner resources
8. Determine owner-contractor work relationship(s) over various project phases
9. Review for alignment

It is not the intent of this report to explain the O/CWS process, but rather provide a discussion as to the logical progression of the process on staffing and the benefits of doing so. An overview of the modified O/CWS Process is included in Appendix A. Figure 2 denotes the process in flowchart format.

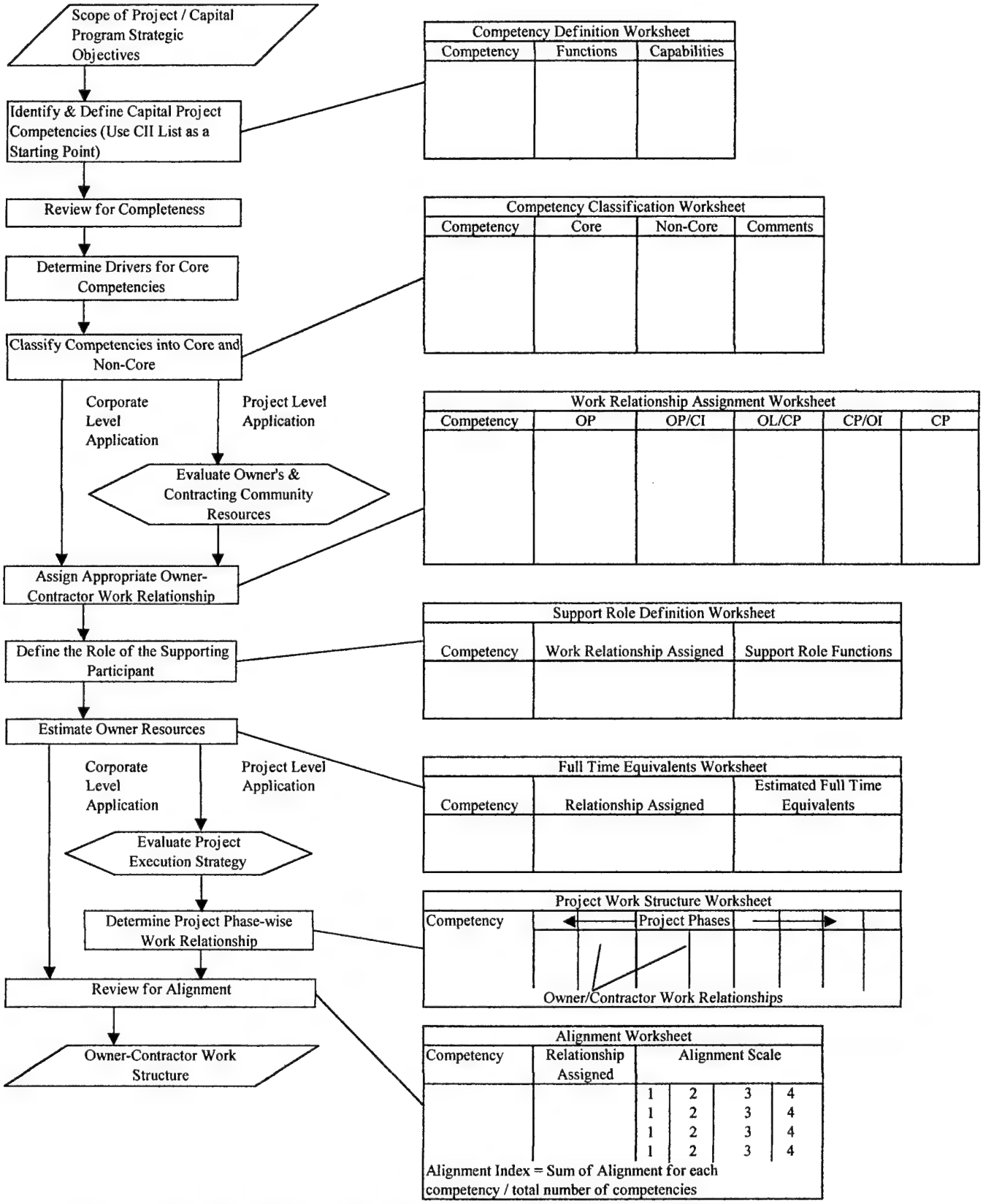


Figure 2. Owner/Contractor Work Structure Process

For capital projects, owners desire high quality work produced quickly and with low cost. For this reason, owners and contractors must form work relationships or work structures that clearly define the major roles and responsibilities of each participant to avoid gaps, to eliminate duplication of effort, and to share risk. (CII, 111-2) This concept of "work relationship" in the O/CWS process is based on the extent of involvement the participants have in the execution of a particular competency. The concept is best explained on a continuum that assumes 100 percent owner involvement on one end and 100 percent contractor involvement at the other end. This relationship is shown in figure 3.

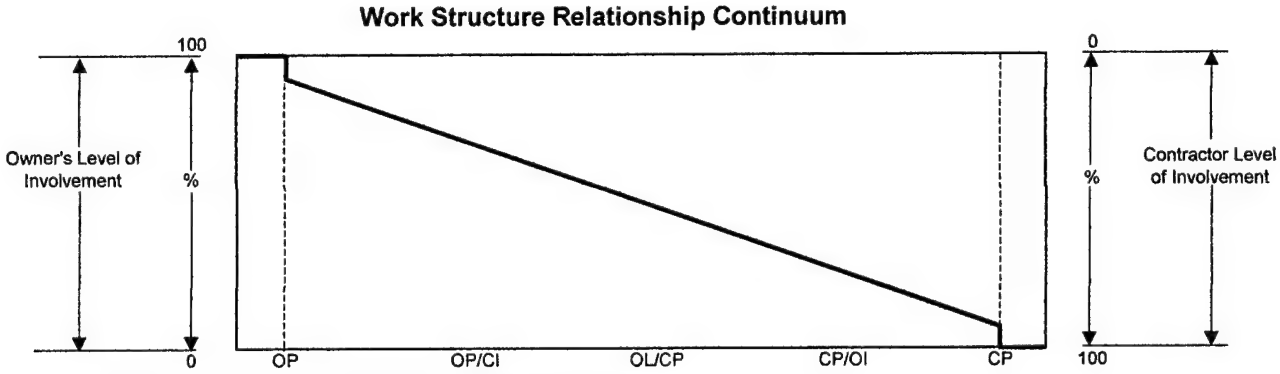


Figure 3. Work Structure Relationship Continuum.

There is a range of relationships that has been identified, through which companies can combine to carry out work. These are defined in terms of who is responsible to perform the work and whose work processes are used. The relationships are:

- Owner Perform (OP), the owner performs all the work with in-house staff and work processes.
- Owner Perform/Contractor Input (OP/CI), Work is done using owner resources and processes, but contractor involvement will be sought for information, data, or analysis.
- Owner Lead/Contractor Perform (OL/CP), the owner leads the process and specifies which of its processes are to be used, but a contractor performs the details with its resources.

- Contractor Perform/ Owner Input (CP/OI), the contractor performs the work with its resources and processes, but the owner has input in the form of data, or approval.
- Contractor Perform (CP), the contractor performs a specified portion of the work with its resources and processes and turns over a finished product.

It is understood then, that the competency functions need to be explicitly identified by members of NAVFAC at various levels of the organization. In this way, NAVFAC will be able to apply the O/CWS process to the functions that describe the work involved in performing each competency and the knowledge, skills, abilities and experience that are necessary to achieve facilities acquisition. Once this has been accomplished and a decision has been made to outsource a function, the O/CWS can assist in developing the responsibilities and deliverables matrix to help eliminate overlapping responsibilities, provide accountability, and ensure that, as problems arise, solutions are managed effectively.

Core Competencies. The O/CWS process forces a systematic review of all competencies required for successful project management and execution. When this information is fully understood, the company can then identify which of those competencies are vital to their business and must be considered to be "core competencies". If a competency is considered core to the business, then the owner must be prepared to either perform that set of skills or at least be in control of them. Those competencies that are not considered core to the business should be assessed for the possibility of contracting to another company or outsourcing to a company that is skilled in performing that function.

Through the O/CWS process, NAVFAC can identify the organization's most important competencies for capital project development and execution. As defined earlier, the competencies are not merely skills and expertise, but actual work processes, such as the facility design function or environmental review process. The work processes or competencies must be reviewed and coordinated as to their importance to the success of NAVFAC, given the organization's objectives. Core competencies are those that must

reside with NAVFAC and are critical to having successful projects. Considerations for the core competencies that the Navy must take into account are:

- What is the relation to the Navy's core business?
- What level of control does NAVFAC want to retain?
- What are the risks and liabilities?
- What are the cost, schedule and quality implications?
- Can NAVFAC still meet the objectives of its mission and fleet support role?

Those competencies that are identified that could be outsourced to a contractor or performed in-house depending on the situation are considered non-core competencies. The Construction Industry Institutes Owner/Contractor Work Structure research team has identified a list of thirty project competencies. These competencies are:

- Alliance/Partnering
- Benchmarking/Metrics
- Business Development
- Commissioning/Startup/ Performance Testing
- Conceptual Cost Estimating
- Constructability
- Construction
- Construction Management
- Convert Research to Project Scale-up
- Definitive Cost Estimating
- Detailed Design
- Environmental /Permits
- Field Quality Control
- Legal/Contract Administration
- Lessons Learned
- Maintenance and Operability Preliminary Design-Scope Development
- Process/Conceptual Design
- Procurement
- Project Controls
- Project Management
- Project Management Oversight
- Project Planning and Scheduling
- Risk Management
- Safety
- Setting Project Goal, Objectives, and Priorities
- Teambuilding
- Technical Expertise
- Total Quality Management

As an agency whose mission it is to provide facilities, NAVFAC has a greater need than typical owners to retain technical, general and project management core competencies to ensure they provide quality facilities better, faster, and cheaper. In a recent publication, Outsourcing Management Functions for the Acquisition of Federal Facilities, NAVFAC identified its core competencies as:

- Master Planning
- Project Planning
- Cost Estimating
- Engineering
- Design
- Construction
- Acquisition
- Project Management

In addition to an engineering organization, NAVFAC is an entity within the U.S. Navy and therefore must consider the support of the American Navy's fleet as core competency.

CONCLUSION

NAVFAC is limited by federal regulations to consider only inherently government functions as core competencies. An inherently government function is defined by one that is related to the public interest and must be performed by government employees. According to a recent study conducted by the National Research Council (NRC), ownership functions, including making decision pertaining to policies, prime contracts or commitment of government funds towards facility acquisitions, should be performed in-house and not be outsourced. Management functions can be outsourced, unless it unduly compromises one or more of the agencies ownership functions. But it is important to note that owner and management functions are equally important for successful facility acquisitions.

NAVFAC is an agency whose mission is to provide facilities, facility acquisition and management in support of the Navy. Therefore, NAVFAC assumes an ownership responsibility as a steward of the public's investment. This responsibility requires that NAVFAC maintain in-house capabilities to act as informed owners and to translate its mission needs directly into program definitions and project specifics and otherwise act in a publicly responsive and accountable manner. (NRC)

Maintaining in-house expertise improves NAVFACs ability to control project outcomes, evaluate contractor performance, and make informed decisions about the contractor selection. Retaining this expertise in-house means that NAVFAC is not dependent on just one person for the success of a project. The Business Roundtable Construction Cost Effectiveness Task Force of 1997 found that owner organizations with better-than-average project acquisition systems all maintained some form of central facilities engineering organization, which was responsible for "providing excellence in project definition, maintaining disciplinary excellence in project management...[and] integrating contractors effectively into their project process. (NRC)

In the public sector, growing concern about the federal budget deficit, the continuing long-term fiscal crisis of some large cities, grassroots efforts to restrain the growth of tax revenue and limit government spending, and efforts to make government more cost effective placed extreme pressure on elected officials to cut the budget and in some cases downsize public agency operations. These and other factors accelerated the change in the process of shifting functions and responsibilities from the government to the private sector (privatization or outsourcing). Thus, more state agencies are turning to outsourcing as a means of performing non-core functions. This entails a change in the skills and numbers of personnel required for the core competencies remaining.

The state departments of transportation are also able to keep a minimum staffing requirement for their offices because during the construction period they were able to hire temporary technicians and inspectors, to supplement the permanent staff wherever needed. Therefore, seasonal employment is a viable option to filling spikes in workload.

Given the size and complexity of facility acquisition for such a large organization, NAVFAC must meet the owner responsibilities by implementing a rational staffing process based on the strategic business plan. By doing so, NAVFAC can experience a 20:1 payback for its investment if reorganized for strategic projects are based on rational and standardized staffing methods.

Current NAVFAC staffing methods are based on a staffing algorithm and projected WIP for the field division. Future workload is taken into account based on managerial judgment and area cost factors. But with increased outsourcing and budget reductions, it is imperative that staffing methods are optimized to select the personnel that can be flexible, maintain a wide range of business and technical knowledge and skills to increase functional performance. Through the O/CWS process NAVFAC can identify the essential technical and management skills that should be retained to ensure effective oversight of the outsourced functions and provide a solid basis to congress for maintaining the estimated work hours required.

The O/CWS process provides a systematic approach to determine organizational and project competencies and the staff sourcing on a corporate level. The O/CWS process is user friendly, but takes dedicated effort to define and align work functions and relationships. A two to three day workshop for this level of organiznation would be sufficient for alignment.

NAVFAC has taken the first steps of the O/CWS process by identifying its core competencies. These competencies are the basis for the number and skills required to ensure successful facility acquisition and management.

RECOMMENDATIONS

As the goal of this report was to compare various staffing methods, the following recommendations are provided:

- NAVFAC needs management, technical, business and leadership skills to successfully accomplish its mission. NAVFAC should evaluate current personnel skills; identify those skills across the organization that may be lost through attrition, reductions, and retirement.

- NAVFAC should evaluate the current staffing method and utilize the O/CWS in order to forecast needs based on projected workloads, technologies, contract types and it's strategic business plan.

- Hire personnel from other public agencies or the private sector who have the training and experience needed to perform the owner and managerial functions required.

- Provide the training required to current employees to acquire the necessary skills and experience to perform the functions.

- Do not outsource all managerial functions. NAVFAC should retain a sufficient level of planning, design, and construction management activity in-house to ensure the organization remains competent with sufficient expertise, high performance and superior quality of work.

- Increase the number of Civil Engineer Corps officer reserve supplements, part-time employees or coop college students during seasonal increases in workload to cover gaps and provide valuable experience and training for future employees or officers.

- Conduct yearly reviews of NAVFACs staff projections both at NAVFAC and EFD levels to assure core competencies are basis for future staffing decisions.

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APPENDIX A

OVERVIEW OF THE OWNER/CONTRACTOR WORK STRUCTURE PROCESS

(O/CWS)

OVERVIEW OF THE MODIFIED OWNER CONTRACTOR WORK STRUCTURE PROCESS

The following paragraphs provide an overview of the modified Owner Contractor Work Structure (OCWS) Process. The 'modifications' refer to improvements in the Implementation Resource 111-2, titled the Owner Contractor Work Structure Process Handbook, and published by the Construction Industry Institute (CII) in 1997. The OCWS process was developed by the CII for evaluating owner-contractor work relationships during the development and execution of capital projects, at the capital program/corporate level and at the project level. This document provides an overview of the improved Owner Contractor Work Structure process, and provides guidelines for using the process at the corporate level and at a capital project level.

The modified OCWS process consists of a set of worksheets to be completed by the project management team assembled by the owner, during the development of capital project(s). The process application as well as the results are significantly more effective when there is adequate representation from all stakeholders, on the owner's project management team. The objectives of this process are: (i) assist owners and contractors in the formation of optimal work relationships; (ii) assist owner companies in "rightsizing" decisions; (iii) address the problem of loss of expertise due to attrition, in the form of retirement and losing people to other companies; and (iv) assist companies in the formation of strategic alliances. The steps involved in the process and the corresponding worksheets are shown in Figure 1. Sample copies of the worksheets are provided in the Appendix. The process makes a distinction in its application at the corporate level and at the capital project level. Though the key concepts are the same at both these levels, the corporate level application precedes the capital project level application. The results of the corporate level application of the process serve as a strategic guideline for using the process for a specific capital project. At the capital project level, there is also an additional element of 'project phase-wise' determination of owner-contractor work relationships. The notion of phases is absent at the corporate level, since it entails strategic evaluation of work relationships on a periodic basis, for as long as the company remains in the business of building capital facilities.

Prior to the application of the OCWS process, the company policies and procedures should be analyzed and understood by the users. In case of a project level application, the project objectives and performance factors, and the scope of the project must be understood to the extent possible. Since the OCWS process is likely to generate a considerable amount of discussion among the user team, it may be more effective when implemented with the help of a facilitator.

The key terms in the OCWS process are as follows:

- **Owner/Contractor Work Structure:** the strategic distribution of roles and responsibilities that are defined in terms of owner-contractor work relationships for each competency, measured on a continuum of the level of involvement of the owner and the contractor (see Figures 2 and 3).
- **Competency:** a process that is comprised of functions and associated critical capabilities needed to develop and execute a capital project.
- **Functions:** activities and tasks that describe the work involved in performing a competency.
- **Critical capabilities:** the knowledge, abilities, skills and experience that are necessary to perform competency functions.
- **Core competency:** a competency that is critical to program success and must be performed in-house.

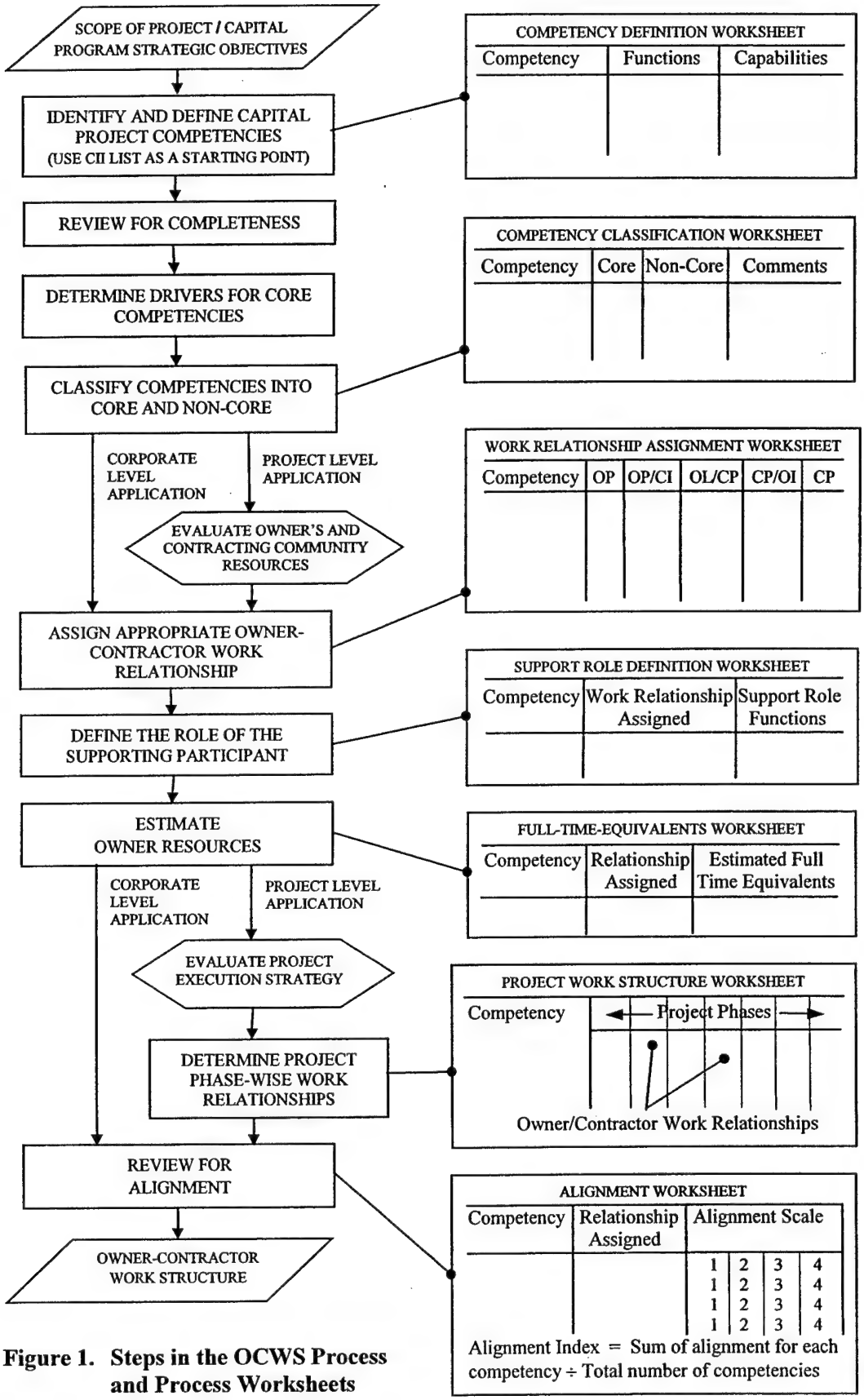

Figure 1. Steps in the OCWS Process and Process Worksheets

- **Non-core competency:** a competency that could either be outsourced or performed in-house, depending on the project circumstances.
- **Work relationship:** a relationship defining the extent of involvement of the owner and the contractor, in performing, leading, and/or providing input with respect to a competency.
- **Project Performance Factors:** project/facility performance targets pertaining to the cost, schedule and operational compliance requirements, as defined by the owner organization.

The concept of "work relationship" in the OCWS process is based on the extent of involvement the participants have in the execution of a particular competency. In the absence of a quantitative parameter to measure the extent of involvement, the concept is best explained on a continuum that assumes 100 percent owner involvement on one end, and 100 percent contractor involvement at the other end. The term "contractor" may imply a contractor, a consultant, a supplier or some such entity that is outside the owner organization. The owner-contractor work relationship continuum is shown in Figure 2.

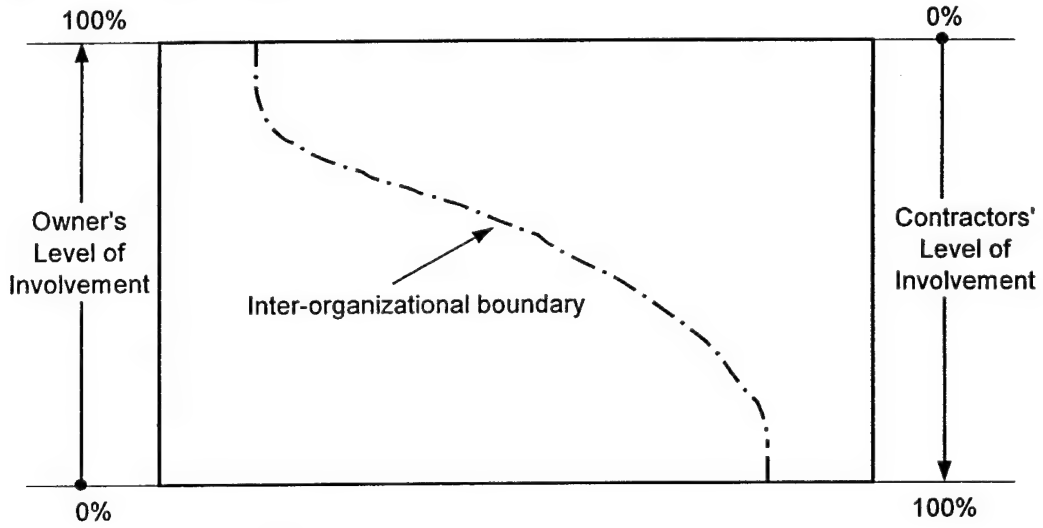

Figure 2. Owner/Contractor Work Relationship Continuum

Five types of owner-contractor work relationships are defined, to characterize the owner-contractor work relationship continuum shown in Figure 2. The five relationships are identified as OP, OP/CI, OL/CP, CP/OI and CP. These are defined as follows:

1. OP: Owner Performed. Owner performs all work involved in the competency using their resources according to their work process.
2. OP/CI: Owner performed using owner's work process with contractor input. Majority of the work is performed using owner resources. Contractor provides input, or acts as a consultant.
3. OL/CP: Owner led with contractor performing the detailed work using owner's work process. Owner leads by setting guidelines, directing, reviewing and approving the work. Contractor performs most of the competency work functions according to the owner's work process.
4. CP/OI: Contractor performed using contractor's work process with input from the owner. Majority of the work is performed using contractor's resources.
5. CP: Contractor performed. Contractor performs all work involved in the competency using their resources according to their work process. The owner can still supply input and guidance by performing the project management oversight.

Figure 3 provides a conceptual illustration of the owner-contractor work relationship continuum for a particular competency, and the application of the five types of owner-contractor work relationships to this continuum. The location of the inter-organizational boundary determines the type of work relationship that is most appropriate for the competency being evaluated.

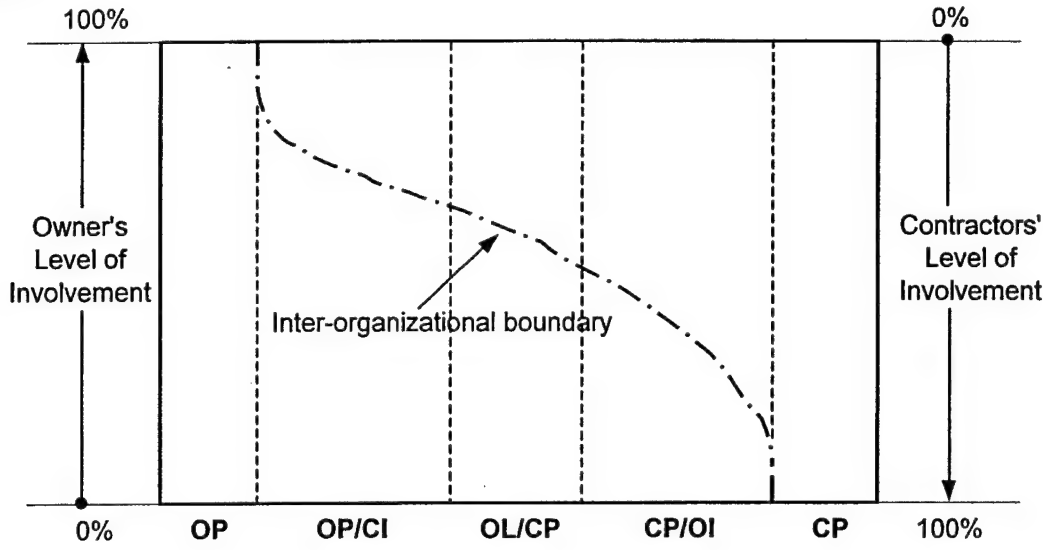

Figure 3. Owner-Contractor Work Relationship(s)

Application of the O/CWS process to defining owner-contractor work relationships at the project level or for the capital program requires that the user(s) have the necessary knowledge and authority to make decisions regarding the commitment of resources to the competencies. Such user(s) may include division managers, project managers, technical managers and operations managers associated with project development and execution. Many of the resource allocation decisions require adequate evaluation of owner and contractor resources by the team. The work relationship framework illustrated in Figures 2 and 3 is intended to assist the users of this process, in conducting this evaluation.

The following paragraphs describe each of the **steps involved in the OCWS process, illustrated earlier in Figure 1.**

1. Identify and define capital project competencies

All key competencies required for capital projects are identified and clearly defined in this step, to clarify the perspectives of various project participants (business units, operations, central engineering). The Competency Definition Worksheet is completed in this step, based on the objectives, project performance factors, company policies and procedures, characteristics of capital project(s) and historical data.

It is important to thoroughly define competencies in terms of the functions and the associated capabilities in terms of the knowledge, skills, abilities and experience. These definitions provide a common language that facilitates a thorough understanding of competencies and the associated work relationships. This also helps the decision-makers in determining the core/non-core classification of competencies, in the next worksheet. Most of the competencies, functions and the associated capabilities are already defined on the Competency Definition

Worksheet. This worksheet provides a list of 30 competencies, approximately 176 functions and about 150 capabilities typically needed on capital projects. A sample worksheet is provided in the Appendix, showing the definitions for three capital project competencies. This information is particularly relevant for clarifying the roles and responsibilities of the owner and contractor, and may be suitably modified depending on the needs of the owner company or the project. An example of competencies, functions and associated capabilities is provided in Table 1.

Table 1. Example of Competencies, Functions and Capabilities

Competency	Functions	Capabilities
Conceptual cost estimating	1. Determine estimate basis (scope) for facility components 2. Determine historical basis 3. Convert estimate basis to costs 4. Check key cost ratios 5. Review estimates with team	1. Ability to visualize the entire project 2. Understand technology involved 3. Design and construction knowledge and experience 4. Understanding of how major facility components fit together 5. Understanding of estimating process 6. Knowledge of project control processes
Environmental compliance/ Permitting	1. Determine what permits are required and when 2. Identify regulatory agencies and establish communication channels with them 3. Acquire and maintain knowledge of requirements 4. Conduct environmental assessments	1. Understanding of laws and corporate facility requirements 2. Understanding of permitting process and relationship to design stages 3. Understanding of owner's business 4. Knowledge of process by-products 5. Engineering knowledge 6. Public relations and communication skills 7. Understanding of risk and liability

2. Review for completeness

A review of the competencies, competency definitions, inherent functions and the associated capabilities is conducted by the team members at this point to confirm that all key competencies are identified and adequately defined in terms of all relevant functions and associated critical capabilities.

3. Determine drivers behind core competency decision

This step helps the team members align themselves with the strategic objectives of the owner company, and the capital project(s) program. The drivers that lead to classifying a competency as core to the owner are evaluated in this step. Typically, such drivers include: i) considerations of proprietary technology; ii) how closely the competency relates to owner's core business; iii) owner's ability to sustain competitive advantage; iv) risk and liability considerations; and v) the cost, schedule and quality implications.

4. Classify competencies into core or non-core

Each competency is classified as either core or non-core, based on the drivers behind core competency decision. A core competency is usually one that is critical to successful project performance, and must therefore reside with the owner. Core competencies are the ones that help the owner sustain a competitive advantage in the business environment. In the words of Peter F. Drucker, a well-known management guru, "... core competencies define where an organization must excel in order to maintain leadership". Core competencies are therefore possessed by few,

they cannot be developed by others easily, and are strategically non-substitutable. Non-core competencies, on the other hand, can be sourced from the market relatively easily, while safeguarding the interests of the project and the company. The classification of each competency as core or non-core is documented on the Competency Classification Worksheet.

5. Assign appropriate owner-contractor work relationship

This step is somewhat different if the process is being carried out at the capital program level, as opposed to using it for a specific capital project. At the capital program level, selecting the most appropriate owner-contractor work relationship from the five alternatives, i.e. OP, OP/CI, OL/CP, CP/OI and CP, is based on the overall strategic objectives of the company. For example, a strategic objective of increasing or reducing the in-house project management staff will have important implications on the choice of owner-contractor relationship. This concept is illustrated below, by applying the owner-contractor work relationship continuum shown in Figure 3, to an individual competency. Figure 4 shows the true nature of the inter-organizational boundary that splits the competency into two. The location on the inter-organizational boundary depends on the extent of contribution of the owner and the contractor towards the execution of that particular competency.

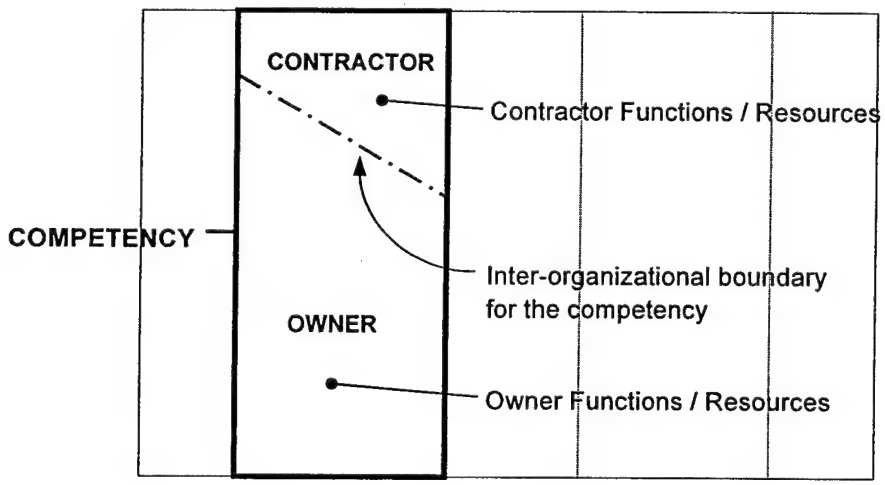

Figure 4. Owner-Contractor work relationship for a competency

On a capital project, the information pertaining to the capital program/corporate level owner-contractor work relationship would be available available. The project management team is therefore required to take into account the owner-contractor work relationship at the capital program level, as well as the adequacy and availability of owner and contractor resources. Based on these considerations, the Work Relationship Assignment Worksheet is completed in this step.

6. Define the role of the supporting participant

The supporting participant refers to "Input" in OP/CI and CP/OI types of relationships, and the "Lead" in the OL/CP type of relationship. Several applications of the original OCWS process have identified the need to define the "Input" and the "Lead" as a crucial aspect of this process. The Support Role Definition Worksheet is created to address this need. This worksheet is completed by identifying specific functions from the Competency Definition Worksheet, that the supporting participant in the relationship is expected to perform.

7. Estimate Owner Resources

Owner resources are estimated in terms of the man-hours and the corresponding Full Time Equivalents (FTEs) of the expected contribution of the owner to the competency being considered. The FTEs are estimated on an annual basis at the capital program level. For a specific capital project, these estimates can be made for the entire project, on a project-by project basis. The Full Time Equivalents Worksheet is completed using this information.

8. Determine owner-contractor work relationship(s) over various project phases

The owner-contractor work relationship is documented *phase-wise* in this step. It is therefore necessary to carry out this step at the project level. It enables the user to incorporate the time element into the project level process, by making changes in work relationships where necessary, during the project life cycle. It is important to consider the impact of the potential project execution strategy while deciding upon the optimal owner-contractor work relationship for various phases of the capital project. Project execution strategy consists of three major elements. They are the type of contract (lump-sum, cost plus incentive/fee), project delivery approach (design-build, design-bid-build, single or multiple contractors and organizational relationship (one-off, repeat business, alliance/partner). The decision regarding project execution strategy is based on the relevant company policies and procedures, strategic objectives of the capital program, project scope, project objectives and the critical success factors. The Project Work Structure Worksheet is completed in this step, based on the Competency Classification Worksheet and the Work Relationship Assignment Worksheet, and the project execution strategy. The completed Worksheet serves as a framework for assigning roles and responsibilities to individual project team members, in the project execution plan. The assignment of phase-wise work relationships must therefore take into consideration that one individual/team may carry out more than one competencies that are related, or require the same skill-base.

9. Review for Alignment

The objective of alignment review is to assess the suitability and effectiveness of the overall owner-contractor work structure, and the individual work relationships assigned to each competency. It could be conducted periodically for the entire capital program. On a specific capital project, it is recommended that the review is conducted at the end of project development, and at the completion of the project, as part of the post-completion project evaluation. The alignment index is calculated separately by each stakeholder, by completing the Alignment Worksheet. The variation in the index calculated by each stakeholder gives an indication of the agreement or disagreement among the stakeholders, on the sourcing and the work relationships being used. This information constitutes valuable input for future determinations of competency sourcing and work relationship decisions.

O/CWS Process Implementation

The steps described in the preceding paragraphs serve as a part of the user organization's strategy for developing and implementing capital projects. Although this process is universally applicable to nearly all types of capital projects, some steps and the sequence of carrying out the steps in the process may require modifications, depending on the needs and operating style of functioning of the user organization. The experience of the research team in the application of this process in owner companies from the United States and Canada has shown that the process works best when implemented with the help of a facilitator.

APPENDIX
(DECISION SUPPORT TOOLS / WORKSHEETS)

SAMPLE WORKSHEETS:

COMPETENCY DEFINITION WORKSHEET			
No.	COMPETENCY AND DEFINITION	FUNCTIONS	CRITICAL CAPABILITES
	Conceptual Cost Estimating: Preparation of estimates at various stages of scope development for purposes of project option selection.	Determine estimate basis for facility components Determine historical cost basis for facility components Convert estimate basis to costs Compare with previous costs Review estimates with project team Approval of cost estimates	Ability to visualize entire project Understand technology involved Design and construction knowledge and experience Understanding of how major facility components fit together Understanding of estimating process Ability to review and understand estimates Knowledge of project controls processes
	Environmental/ Permits: Ensuring compliance with environemntal laws regulations, filing permits applications, and site assessments.	Determine what permits are required and when Identify regulatory agency/ies Establish and maintain communication links with regulators and facilities Acquire and maintain knowledge of requirements Coordinate and conduct environmental assessments Apply for permits	Understanding of laws and corporate and facility requirements Understanding of permitting processes and relationships to design stages Understanding owner's business Knowledge of process by-products Environmental engineering knowledge Public relations and communications skills Understanding of risk and liability
	Project Management: Management and coordination of project development and execution.	Manage assigned resources to achieve project objectives Interpret and communicate project goals to team members Assemble project team Establish project organization and accountabilities Ensure team has access to resources, tools, equipment to conduct work Initiate development of project execution plan and monitor its implementation Report project status to stakeholders Maintain customer interface Establish or approve project monitoring and control systems	Communication, people, and problem solving skills Knowledge of project management processes Knowledge of skill sets of project tem members Knowledge of owner organization and processes Knowledge of policy, legal and regulatory needs of projects Knowledge of project objectives Knowledge of organizations' needs and dynamics Knowledge of corporate citizen needs Knowledge of external stakeholder organizations Knowledge of labor relations

COMPETENCY CLASSIFICATION WORKSHEET

No.	COMPETENCY AND DEFINITION	Classification		COMMENTS
		CORE	NON-CORE	
	Conceptual Cost Estimating: Preparation of estimates at various stages of scope development for purposes of project option selection.	X		Drivers for the core classification are: front end functions, cost effectiveness and risk tolerence.
	Environmental/ Permits: Ensuring compliance with environemntal laws regulations, filing permits applications, and site assessments.	X		Drivers for the core classification are: risk and liability considerations
	Project Management: Management and coordination of project development and execution.		X	Oversight will be provided by the owner.
	TOTALS:			

Notes: Place an "X" in the box under the appropriate column, depending on the drivers that lead to deciding whether the competency is Core or Non-Core.

WORK RELATIONSHIP ASSIGNMENT WORKSHEET

No.	COMPETENCY	Owner/Contractor Relationship					"C"	COMMENTS
		OP	OP/CI	OL/CP	CP/OI	CP		
	Conceptual Cost Estimating: Preparation of estimates at various stages of scope development for purposes of project option selection.		X				Cons-ultant	
	Environmental/ Permits: Ensuring compliance with environemntal laws regulations, filing permits applications, and site assessments.			X			Cons-ultant	
	Project Management: Management and coordination of project development and execution.				X		EPC Contr-actor	
	TOTALS:							

Notes: Place an "X" in the box under the most appropriate work relationship column. Define "C" depending on whether it implies a Contarctor or otherwise.
Five types of work relationships: OP - Owner Performed; CP - Contractor performed; OP/CI - Owner performed using Owner's work process and contactor input;
OL/CP - Owner led with contractor performing the work using Owner's work process; CP/OI - Contractor performed using contractor's work process & Owner input.

SUPPORT ROLE DEFINITION WORKSHEET

No.	COMPETENCY AND DEFINITION	RELATIONSHIP ASSIGNED	SUPPORT ROLE FUNCTIONS (SELECTED FUNCTIONS FROM COMPETENCY DEFINITION WORKSHEET)
	Conceptual Cost Estimating: Preparation of estimates at various stages of scope development for purposes of project option selection.	OP/CI	Convert estimate basis to costs Review estimates with project team
	Environmental/ Permits: Ensuring compliance with environemntal laws regulations, filing permits applications, and site assessments.	OL/CP	Coordinate and conduct environmental assessments Apply for permits
	Project Management: Management and coordination of project development and execution.	CP/OI	Assemble project team Maintain customer interface Approve project monitoring and control systems

* Specific functions must be identified for "Input" in OP/CI or OI/CP, and "Lead" in OL/CP type of work Structure

PROJECT WORK STRUCTURE WORKSHEET

No.	COMPETENCY	PROJECT PHASES (TYPICAL)						
		Define Business Needs	Develop Concept	Preliminary Design	Detail Design	Procure Equip. and Materials	Construct Design	Start-Up
	Conceptual Cost Estimating		OP/CI	OP/CI				
	Environmental/ Permits		OL/CP	OL/CP	OL/CP			
	Project Management			CP/OI	CP/OI	CP/OI	CP/OI	

1. Project phases are based on the typical project development and execution process in the user organization.
2. Place an OP, OP/CI, OL/CP, CP/OI or CP in the appropriate box under the phase in which the relationship is most appropriate for the competency.

FULL TIME EQUIVALENTS WORKSHEET

No.	COMPETENCY	RELATIONSHIP ASSIGNED	ESTIMATED OWNER MAN-HOURS	FULL TIME EQUIVALENTS	COMMENTS
	Conceptual Cost Estimating	OP/CI	2180	1	
	Environmental / Permits	OL/CP	3120	1.5	
	Project Management	CP/OI	1080	0.5	Primary responsibility of the EPC contractor. Owner will rely on Project Management Oversight competency.
		TOTAL:			

WORK STRUCTURE ALIGNMENT WORKSHEET

No.	COMPETENCY	WORK RELATIONSHIP	ALIGNMENT SCALE				COMMENTS
	Conceptual Cost Estimating	OP/CI	1	(2)	3	4	
	Environmental / Permits	OL/CP	1	2	(3)	4	
	Project Management	CP/OI	1	2	3	(4)	

1. Record the assigned relationship from the Sourcing and Work Structure Assignment Worksheet under the column titled "Work Relationship".
2. Based on the criteria for measuring alignment, circle the appropriate number on the Alignment Scale.
3. Record any additional comments under the column titled "Remarks".

Alignment Index:

$$\frac{\text{Sum of Alignment score for each competency}}{\text{Number of total competencies used}} = 3$$

Scale:
1 - Least Appropriate
2 - Less Appropriate
3 - Appropriate
4 - Most Appropriate

APPENDIX B

Questionnaires

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1510 GILBERT ST
NORFOLK, VA 23511-2699

TELEPHONE NO:
(757) 322-8435

IN REPLY REFER TO:
CI51:JPM
9 April 2001

LT Michael Monreal
Texas A&M University
NROTC Unit – Graduate Students
Post Office Box 2920
College Station, Texas 77841-2920

Re: RESIDENT OFFICER IN CHARGE OF CONSTRUCTION STAFFING QUESTIONNAIRE

Dear LT Monreal,

I have received your letter of 25 March 2001, concerning staffing of ROICC Offices in the Atlantic Division, Naval Facilities Engineering Command. You may not realize that the Atlantic Division is not staffed like Southwest Division and the rest of NAVFAC is staffed differently, within components. The Atlantic Division has five components - Middle Atlantic, EFA Northeast, EFA Chesapeake, EFA Mediterranean, and OICC Naples.

Attached is a sheet that lists the answers to your questions. The numbers for staffing I have provided are based upon the yearly gates, but the actual numbers may fluctuate due to losses and hiring against those losses during any year. One question, which I cannot answer definitively for you, is the breakdown of technical and non-technical personnel in each of the components. I have provided the same percentage of the total field staff in each of the components, as I feel statistically that this will be consistent in the Atlantic Division.

Should you have further questions or need clarification of any of the responses, please contact Mr. John McLaren at (757) 322-8435.

R. J. CLARK
Captain, CEC, USN
Operations Officer

1. **How many field offices and how many personnel (military civilian, technical and non-technical) are in your division?**

Component	MIDLANT	NORTH	CHES	MED	Naples
Fld office #'s	12	10	8	11	1
Auth #'s					
Civilian	266	108	141	75	19
Military	39	18	29	27	5
Technical	182	75	102	61	14
Non-tech	123	51	68	41	10

2. **What is considered to be the issue, if any, in staffing the ROICC field offices compared to their current workload?**

There are a number of issues that are considered in the staffing of a ROICC field office in addition to current workload. Primary consideration is the projection for future work and the workload trend for that office over the last five years. We will bridge a one or two year dip in work for the office and will tunnel through a corresponding spike in work. The hiring and movement of civilian personnel is a great consideration in the process of determining size of the office, but this does not deter the reduction of staff for a long term drop in workload. We look at dispersion of the office, some offices may support seven geographically dispersed clients. We look at the type and size of the work, a single $40 million switchgear contract may only require a single ARO(E)ICC and one CON REP, supported by a Contract Specialist from another office.

3. **What is the basis for the current staffing models in use by your division?**

The current model for staffing is based upon the NAVFAC model. This model is an algorithm which is adjusted for the local area cost factor and is, for overseas locations adjusted again for difficulty in getting materials etc. The algorithm is based upon WIP, submitted to the Command ESG where the numbers are massaged during a Resource Allocation Process, reviewed again by the business line managers for the Command, and presented to NAVFAC. NAVFAC looks at the organization as a whole, in light of the Navy's funding for the upcoming year, and we are given a number of hours to distribute to our components to man the field. The hours provided might only total 85 – 90 % of the algorithm.

The algorithm is as follows:

$$WH = \frac{(WIP * Ko)/ [(ACF - 1) /2 + 1]}{1250}$$

WH = Work Hours
WIP = Work In Place
Ko = 1.0 CONUS or 1.3 OCONUS
ACF = Area Cost Factor
Constant (1250) derived from historical data

4. What are the methods of field office staffing used by your division? (What are the formulas you use and how / where did they originate?)

The methods for staffing field offices are many and are based upon all of the factors listed in answer 2 and 3 above. We staff our offices based upon the work being done and in conjunction with any specialty requirements the office may have. We look at trying to keep each office in a range of about $2million + / person. This is not a hard and fast criterion and it has to be adjusted on the situation. We do use the formula mentioned above in answer 3 and we do also look at the NFOR model, which was recently developed by NAVFAC. The NFOR model was developed by the Emergency Operations Center at NAVFAC in 1998 and has been changed a couple of times over the last few years. The NFOR model is:

$$Staffing = \frac{WIP1}{1.8*Afc} + \frac{WIP2}{1*Afc} + \frac{FIP}{2*Afs}$$

WIP1 = Type I Construction
WIP2 = Type II Construction
FIP = Facilities Service Contracts
Afc = Adjustment Factor for Construction (ACF –1)/ 2 + 1
Afs = Adjustment Factor for Services (ACF – 1)/ 3 + 1
ACF = Area Cost Factor

The final numbers for all models are then compared with the Man-Hours provided by NAVFAC, distributed to each component, and the components staff their offices based upon each offices needs.

25 Mar 01

MEMORANDUM

From: LT Michael Monreal, CEC, USN
To: Operations Officers, Engineering Field Activities and Divisions

Subj: RESIDENT OFFICER IN CHARGE OF CONSTRUCTION STAFFING QUESTIONNAIRE

1. I respectfully request your assistance in answering this questionnaire for graduate level research. My name is Lieutenant Mike Monreal and am currently assigned to graduate school at Texas A&M University. My focus in graduate school is construction engineering and I have chosen a research topic that is of importance to the Naval Facilities Engineering Command and it's construction contracts offices. My experience in contract administration is from ROICC Camp Pendleton, CA from 1996 to 1998 during the re-engineering of Southwest Division under RADM Johnson and the BRAC moves of the 1990s.

2. As a team leader for several projects, one of the issues in which I faced was the proper staffing of the project teams compared to the construction workload. This topic has been previously questioned, as it is one of the suggested research topics from the Civil Engineer Corps graduate school list of topics.

3. The scope of this report is to research and identify current trends in the NAVFAC construction contract field offices concerning workload and staffing. This questionnaire represents the first of two series of activities where I plan on identifying current methods of staffing by the various Engineering Field Activities and Divisions. With data from the second series of questions I will compare the methods to current best practices as researched and formalized at the Construction Industry Institute, University of Texas at Austin. I shall then identify possible staffing methods for consideration by NAVFAC and the various Engineering Field Activities and Divisions. The actual methods will require further research to conclusively identify the correct method for the EFDs and is outside the scope of this report. But my goal is to provide suggestions and current best practices from today's construction industry and make them available for your consideration.

4. The following questions are submitted:

- How many field offices and how many personnel (military and civilian, technical and non-technical) are in your division? ***10 Field Offices, 21 Military, 151 civilian personnel (71 at EFA Med HQ, 80 in the field) and 9 Title II employees.***

- What is considered the issue, if any, in staffing the ROICC field offices compared to their current workload? ***There are several major issues.***

1) Workload tends to vary significantly in the European theater, with peaks and valleys.

2) We have to maintain a presence at certain locations throughout the theater. Some small offices require a minimum amount of staffing that is not supported by workload numbers (i.e. you need engineering, contracting and administrative capabilities).

3) We are known as a good model of a forward, lean organization. Therefore, there is a general reluctance to see us grow to any great extent.

- What is the basis or reference for the current staffing models in use by your division? ***The current model is that used by NAVFAC, the EDM. For the ROICC offices, we deal mainly with the "G" and the "Y" lines, construction and facility support. The formulas appear rather random, but at least it gives a basis for comparison across organizations. These models are intended to cover the effort at both the field, EFA HQ, and EFD HQ; they are used globally and are not intended to be used at the ROICC office level (if you try apply, the large offices get more than they need and the small offices get less than they need).***

- What are the methods of field office staffing used by your division? (What are the formulas you use and how/where did they originate?) ***LANTDIV used to use the "LANTDIV Model" to determine staffing, an in-house model that would give out numbers of military and civilians of the different types based on workload. This only applied to construction, not FSC. There are many new areas of work for our offices that are not covered, i.e. leasing, vehicle leasing, A/E contracting, etc. It seems especially difficult to pin down contract specialist staffing. They no longer seem to refer much to the "LANTDIV" model, so it makes field office staffing difficult, more of a "gut feel" approach. The "G" and "Y" line models include staffing at HQ of the various organizations, so it does not help in determining individual ROICC office staffing. If you need any of the models and have not received them from other sources, let me know and I'll try get them for you for reference.***

5. Please answer the questions in Word document format and forward them to msmonreal@msn.com. In order to compile the data and begin analysis I request the questionnaire be returned to the above email address by April 25, 2001. Thank you for your effort in my research area. I will forward you a synopsis of my findings upon completion. For further questions or clarifications please email or call me at (979) 268-9996 or (979) 777-8289.

If you need any other more detailed information, let me know. This is what I end up spending most of my time on-

//signed//
MICHAEL MONREAL